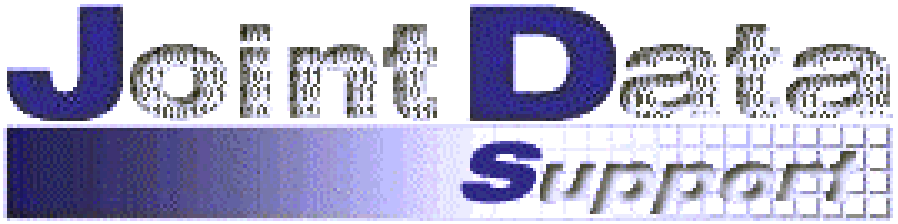


Providing Quality Data to DoD Analytic Studies

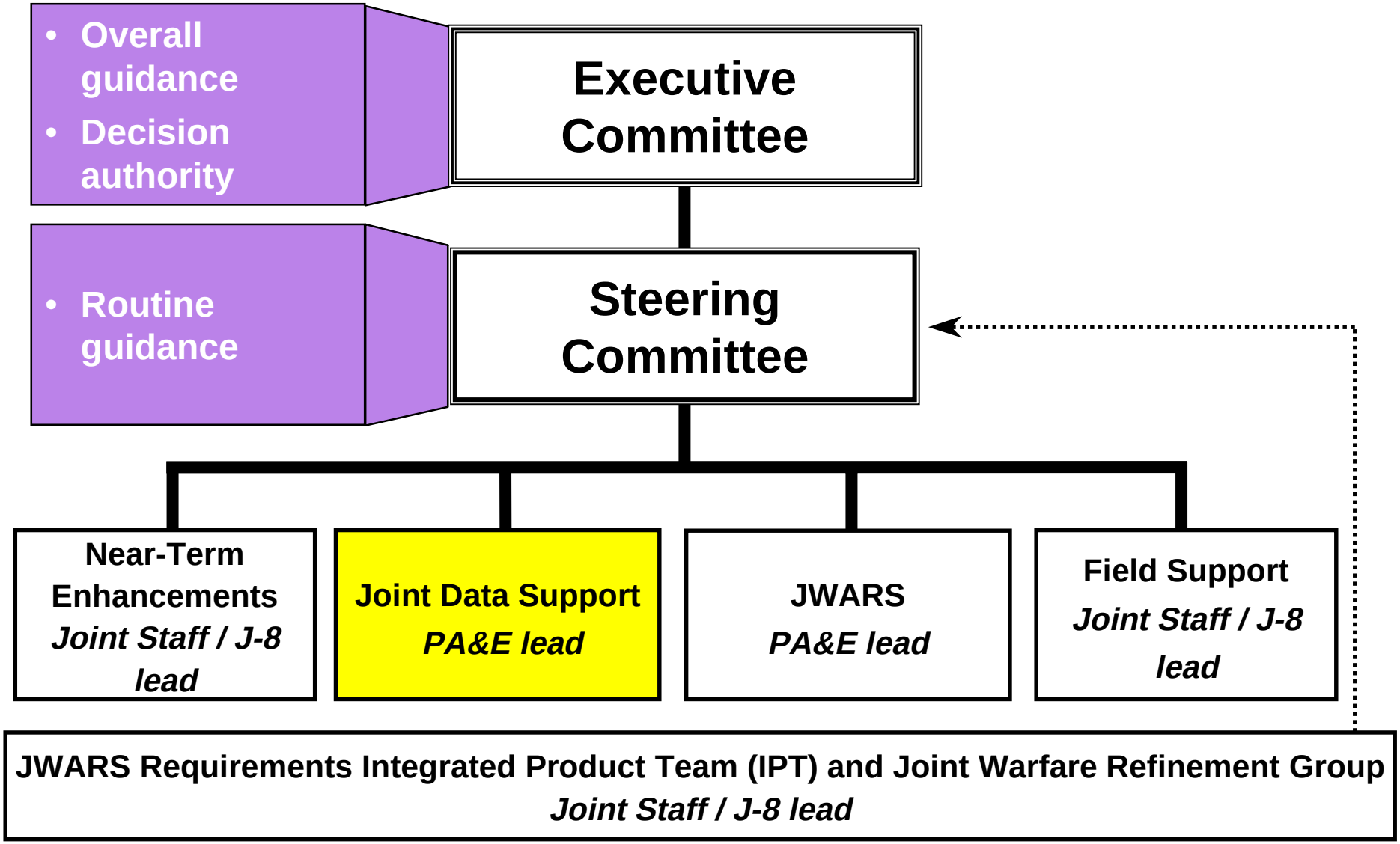
Elaine Simmons

Program Analysis & Evaluation

Office of the Secretary of Defense

June 18, 1999

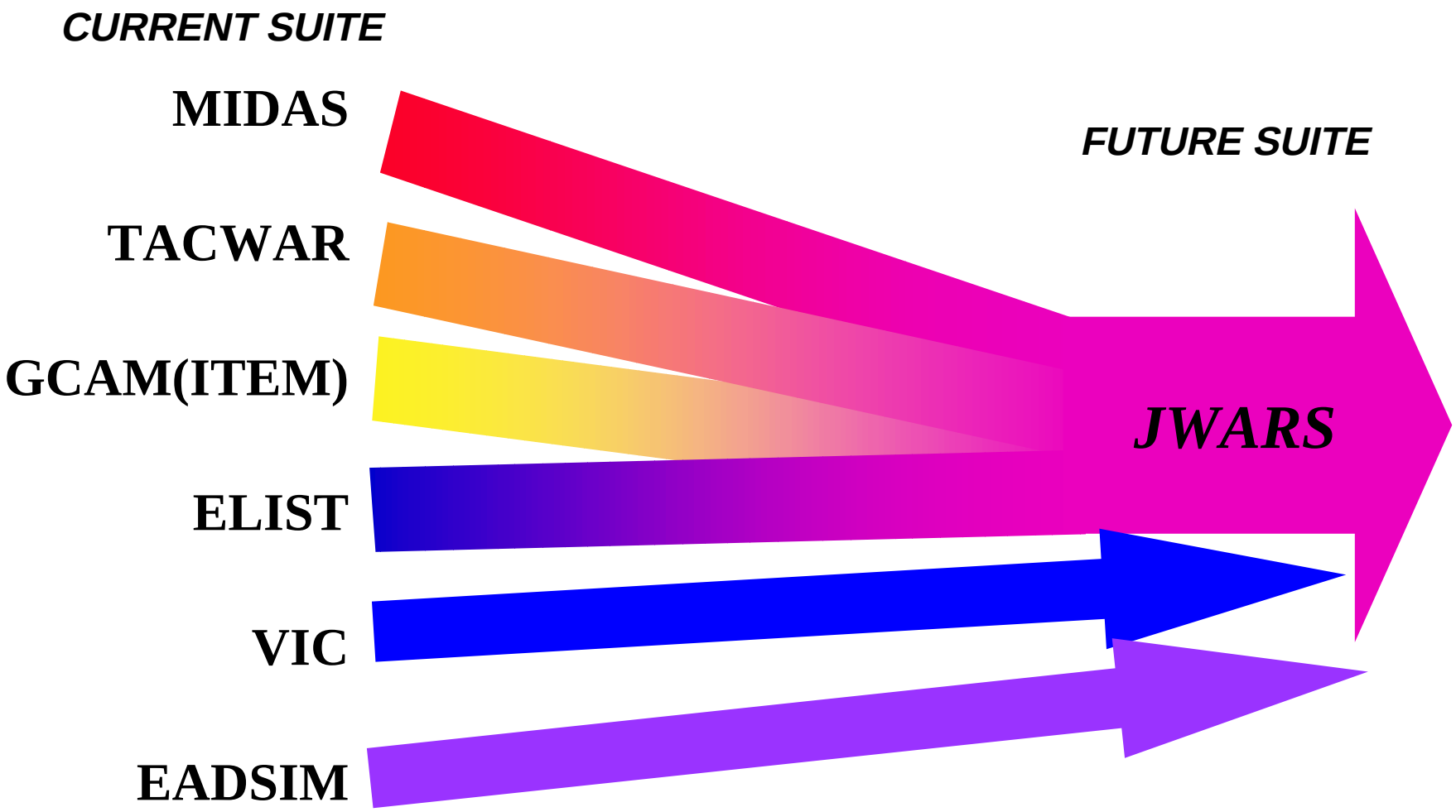
JAMIP Organization and Management Structure



Charter

- **Support the Joint Analytic Model Improvement Program (JAMIP) suite of models**
- **Support JWARS Development and Fielding**
- **Improve Quality and Consistency of DoD Analyses**

JAMIP Models



JDS Objectives for Supporting Studies

- **Improve quality of data used in DoD studies**
- **Provide consistent, authoritative data across studies**
- **Reduce model set up time**
- **Allow study teams to focus on the analysis**
- **Reduce duplication of effort**

Key Challenges in Supporting Analytic Studies
Data Issues

- **Gap between source data and model requirements**
  - **Level of detail**
  - **Different assumptions underlying key variables**
- **Data Quality**
  - **Anomalies and gaps within a database**
  - **Inconsistencies in content among comparable databases**
- **Heterogeneous Source Environment**
  - **Disparate schema and non-standard definitions across databases**

JDS Basic Principles for Supporting Studies

- **Resolve data issues early in the study**
- **Adhere to formal data access and release procedures**
- **Document and archive key data products, transformations and study artifacts**
- **Provide easy access to data via secure, web-based tools**
- ***LEARN BY DOING!***

Resolve Data Issues

Essentials of the Analytical Process

- **Define data requirements**
- **Transform data keyed to study requirements**
  - **Scrub for internal consistency, referential integrity**
  - **Map/"bin" data**
  - **Compare and reconcile information across databases**
  - **Work with sources to fix anomalies**
  - **Highlight judgment calls to study team**
- **Establish a baseline position for consistency across modeling efforts**

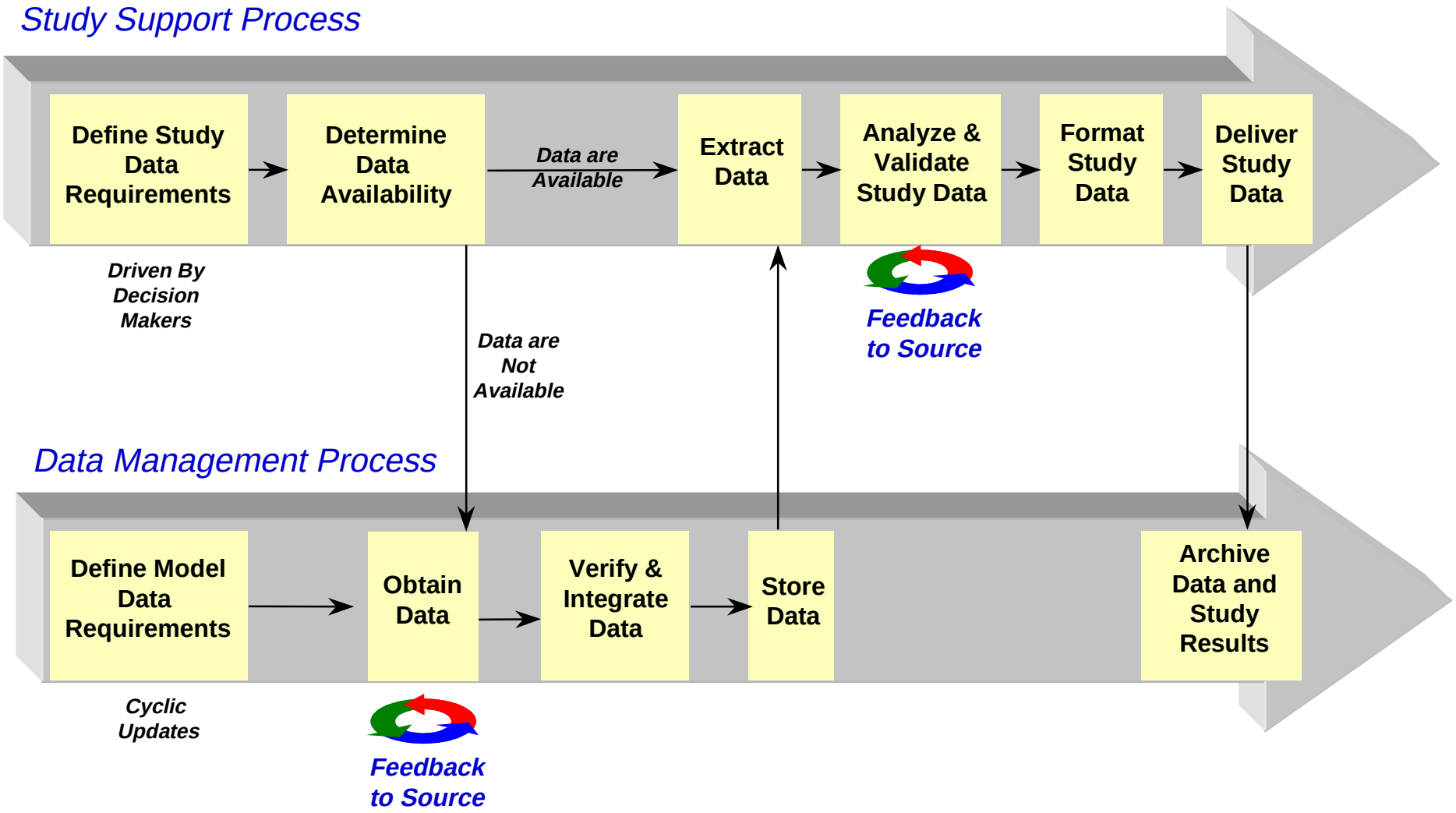
Joint Data Support

Recent Data Support for Analytic M&S

Study	Types of Data	User
Experiment in Modeling Focused Logistics	TPFDD	PA&E/J-4
	Consumption Rates	
Mobility Requirements Study -- 05	TPFDD	J-8/J-4/OSD/ TRANSCOM/ Services
	Lift Assets	
	Network	
	Warfight	
Reserve Component Employment Study	MRS-05 Mobility Data	J-8/Services/IDA
	Current/2005 US Forces	
Capabilities-Based Munitions Requirements	Warfight	J-8/Services
	Weapons Effectiveness	
Joint Interdiction	Warfight	J-8/RAND
	Weapons Effectiveness	
	Force Flow	
JWARS Development	→	

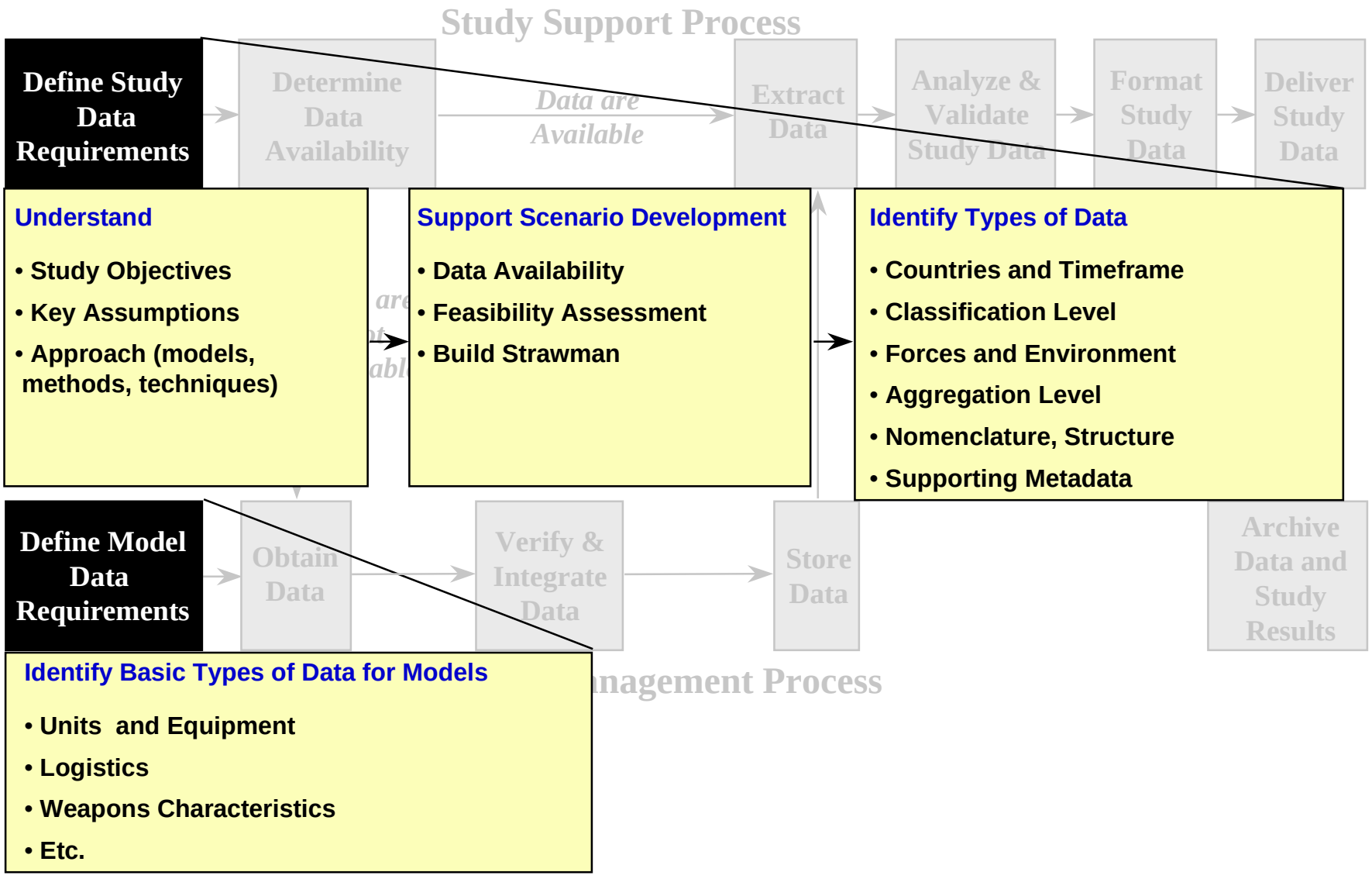
Joint Data Support Data Process

Overview



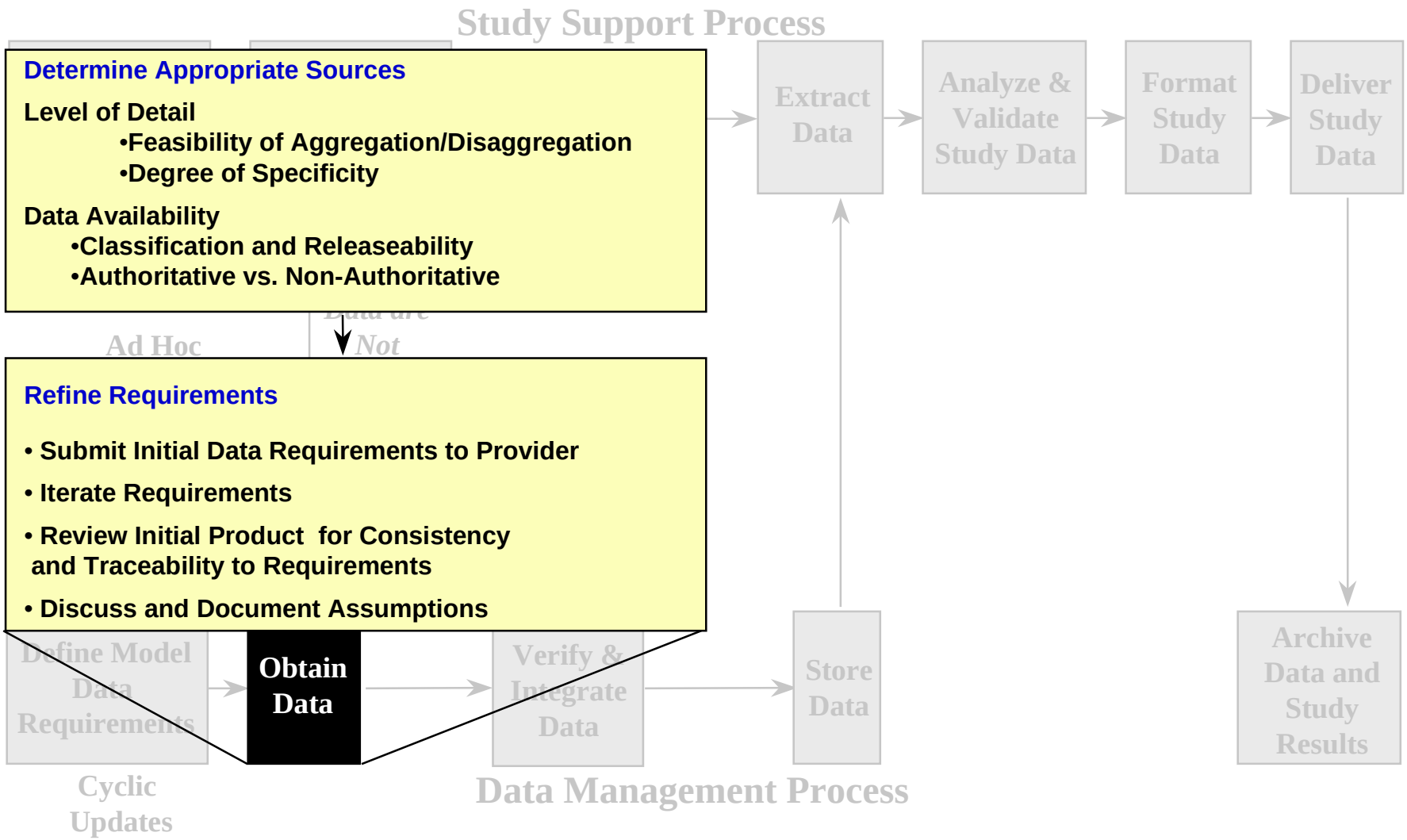
Joint Data Support Process

Define Requirements



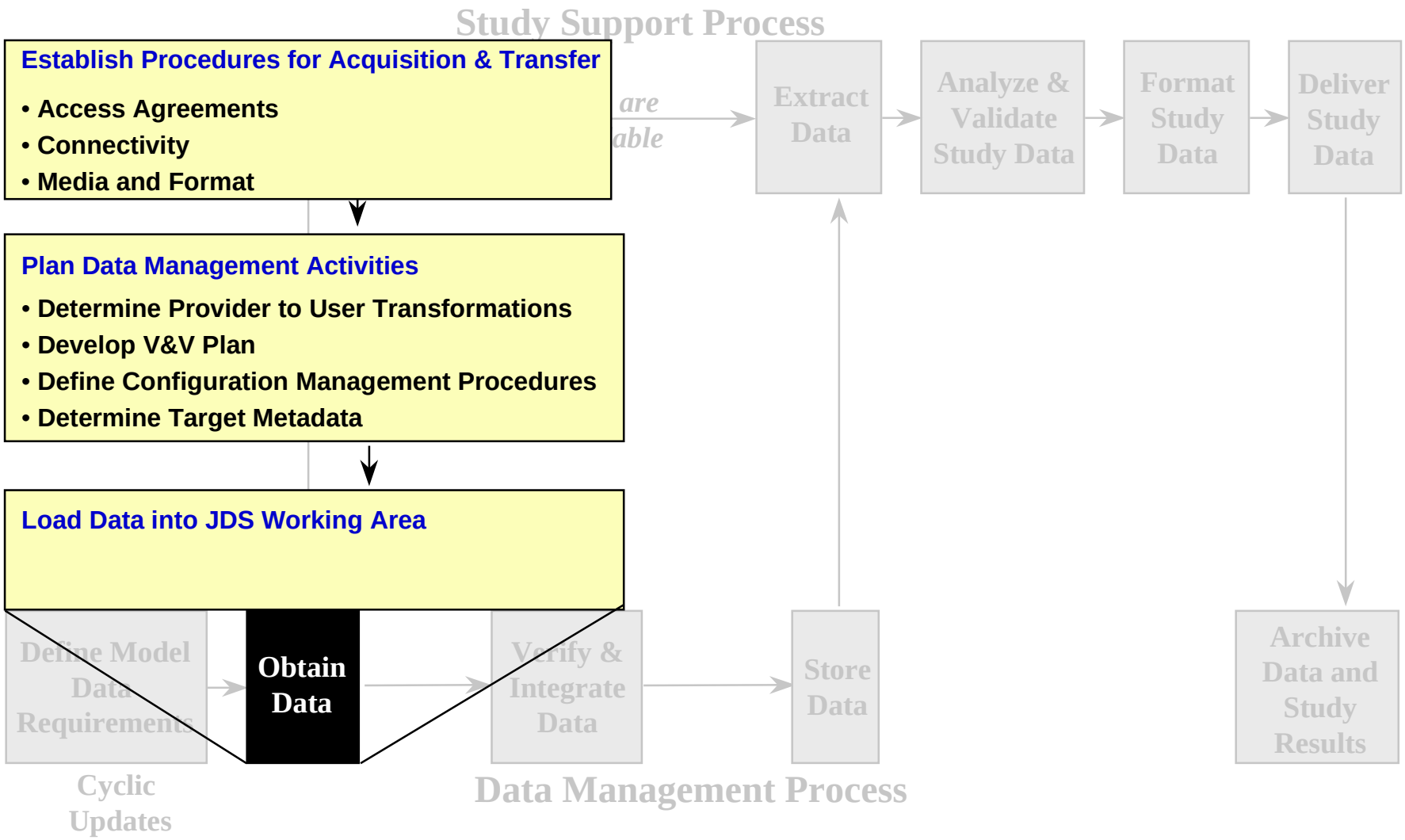
Joint Data Support Process

Obtain Source Data--Part I



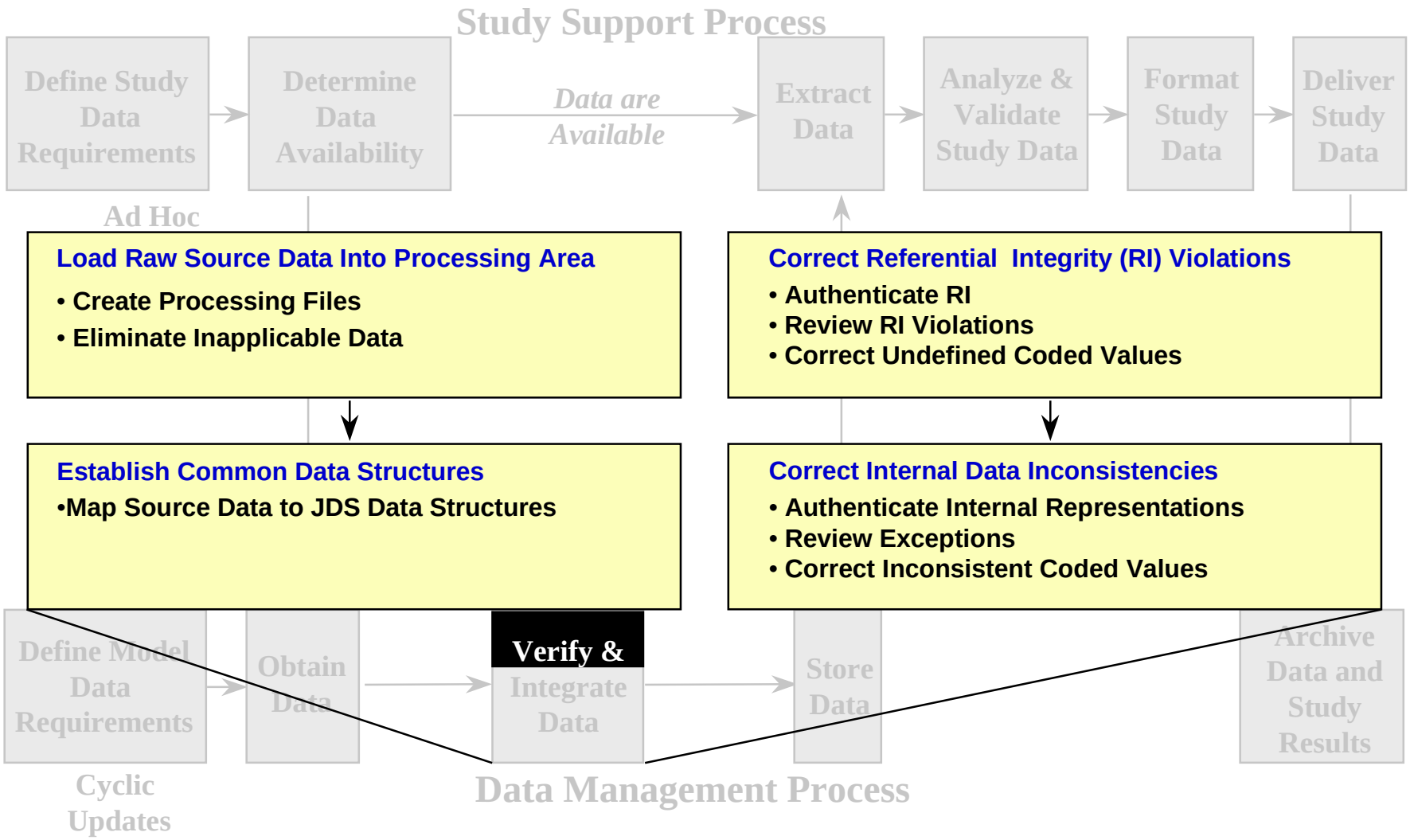
Joint Data Support Process

Obtain Source Data--Part II



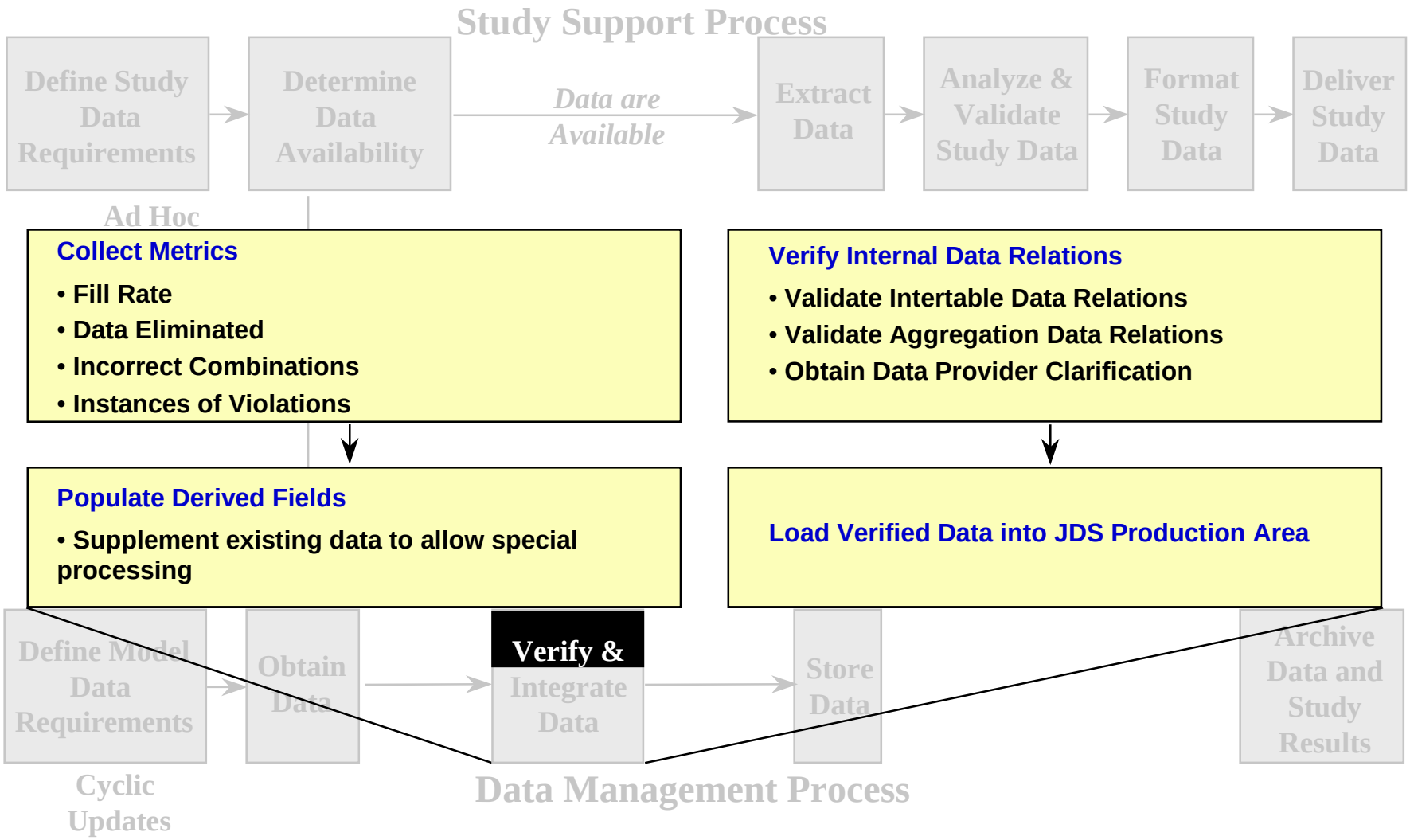
Joint Data Support Process

Verify the Data--Part I



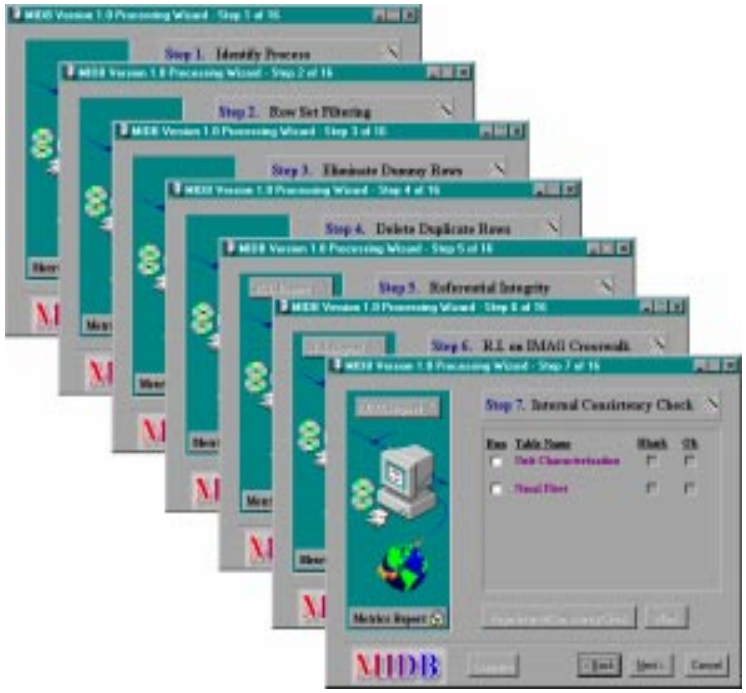
Joint Data Support Process

Verify the Data--Part II

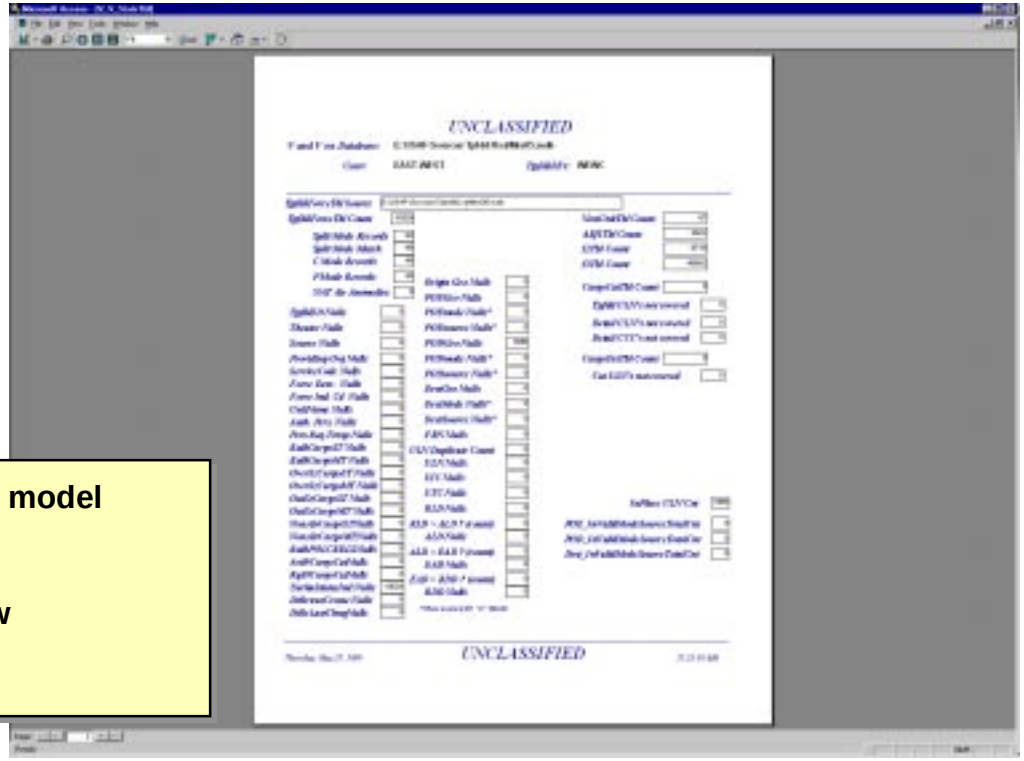


Examples of JDS Data Verification

MIDB Verification



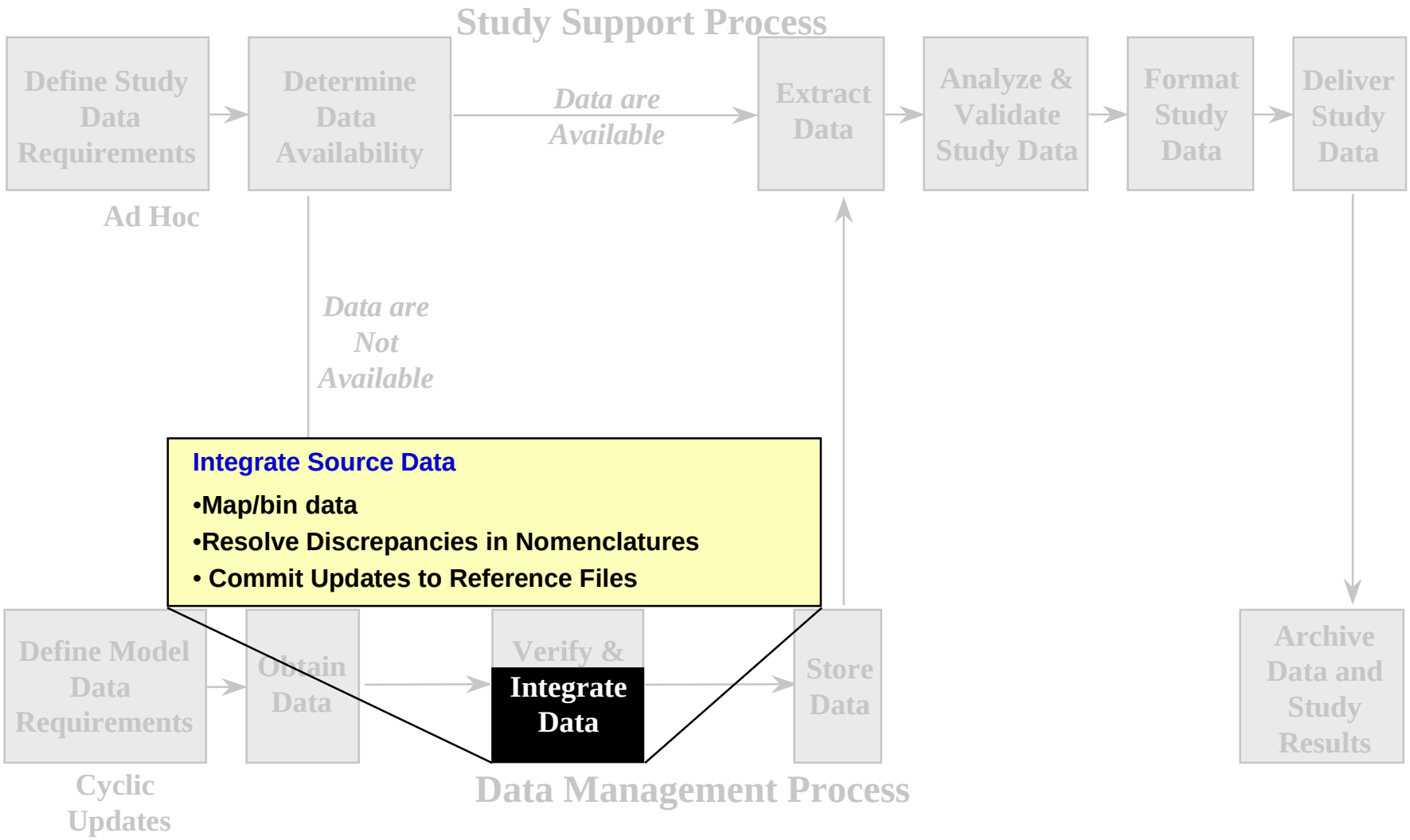
TPFDD Verification



- **Data Verification is based on a generic processing model**
- **Specific applications are unique to each source**
- **Exception reports generated require analyst review**
- **Feed back anomalies to source for resolution**

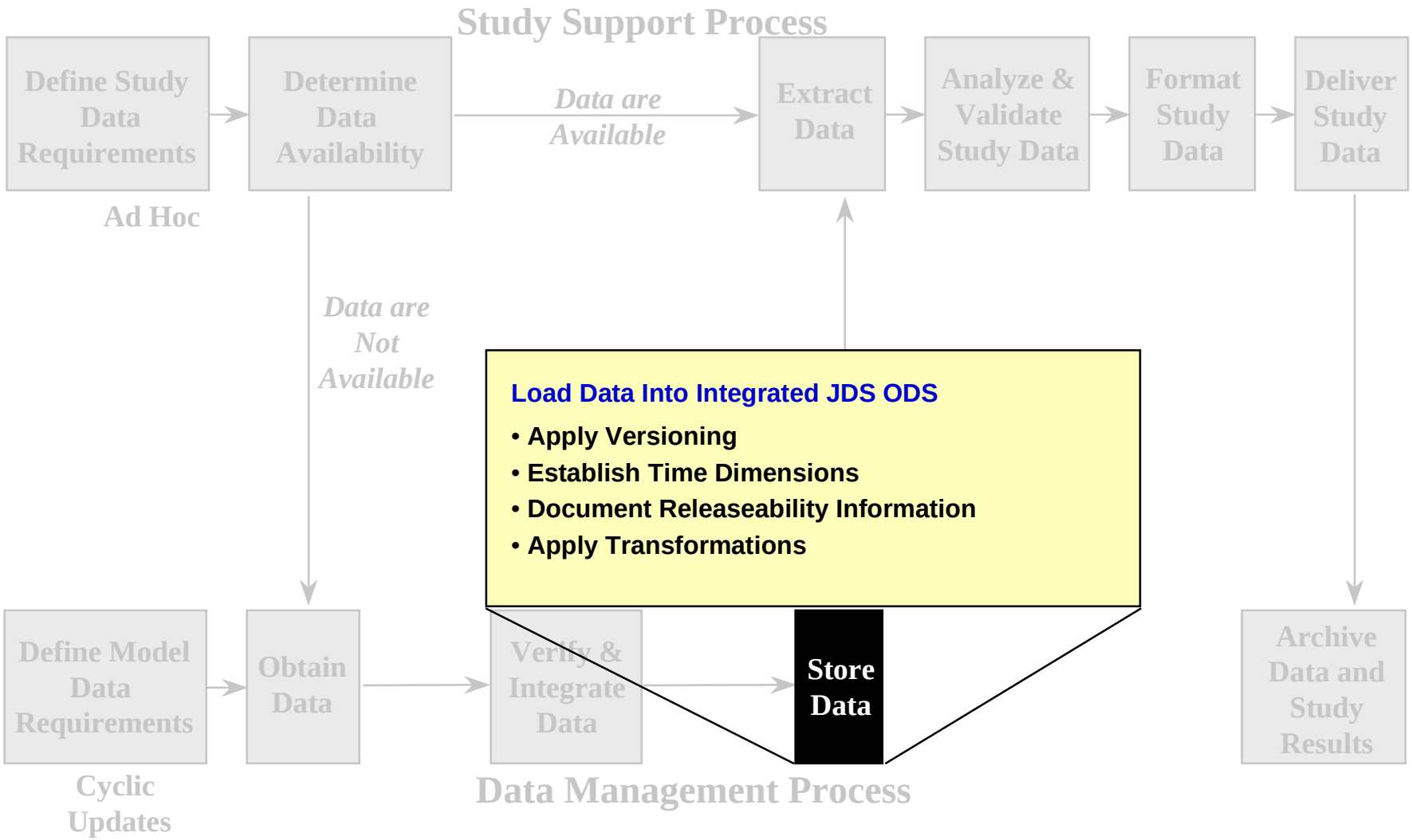
Joint Data Support Process

Integrate the Data

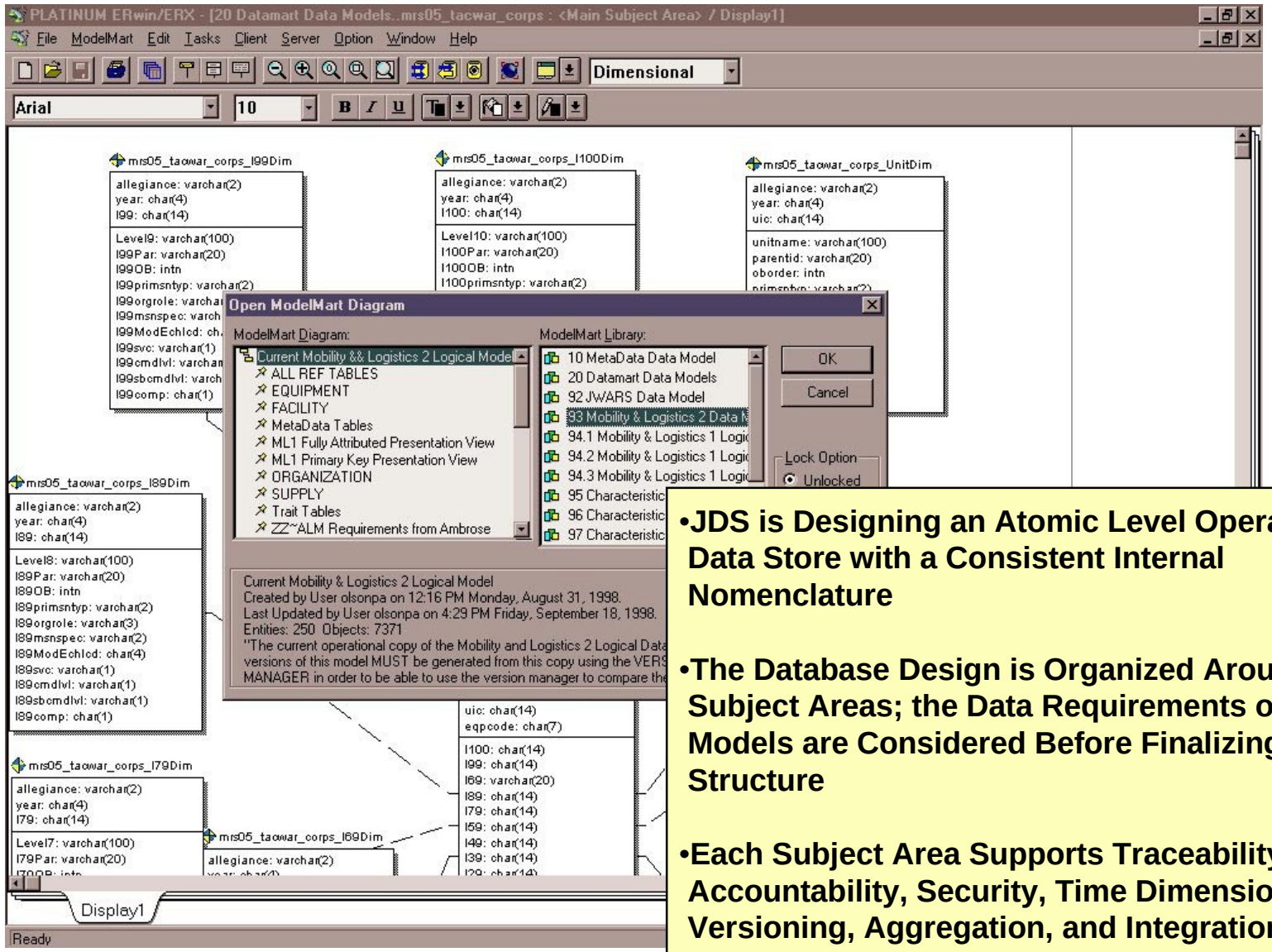


Joint Data Support Process

Store the Data



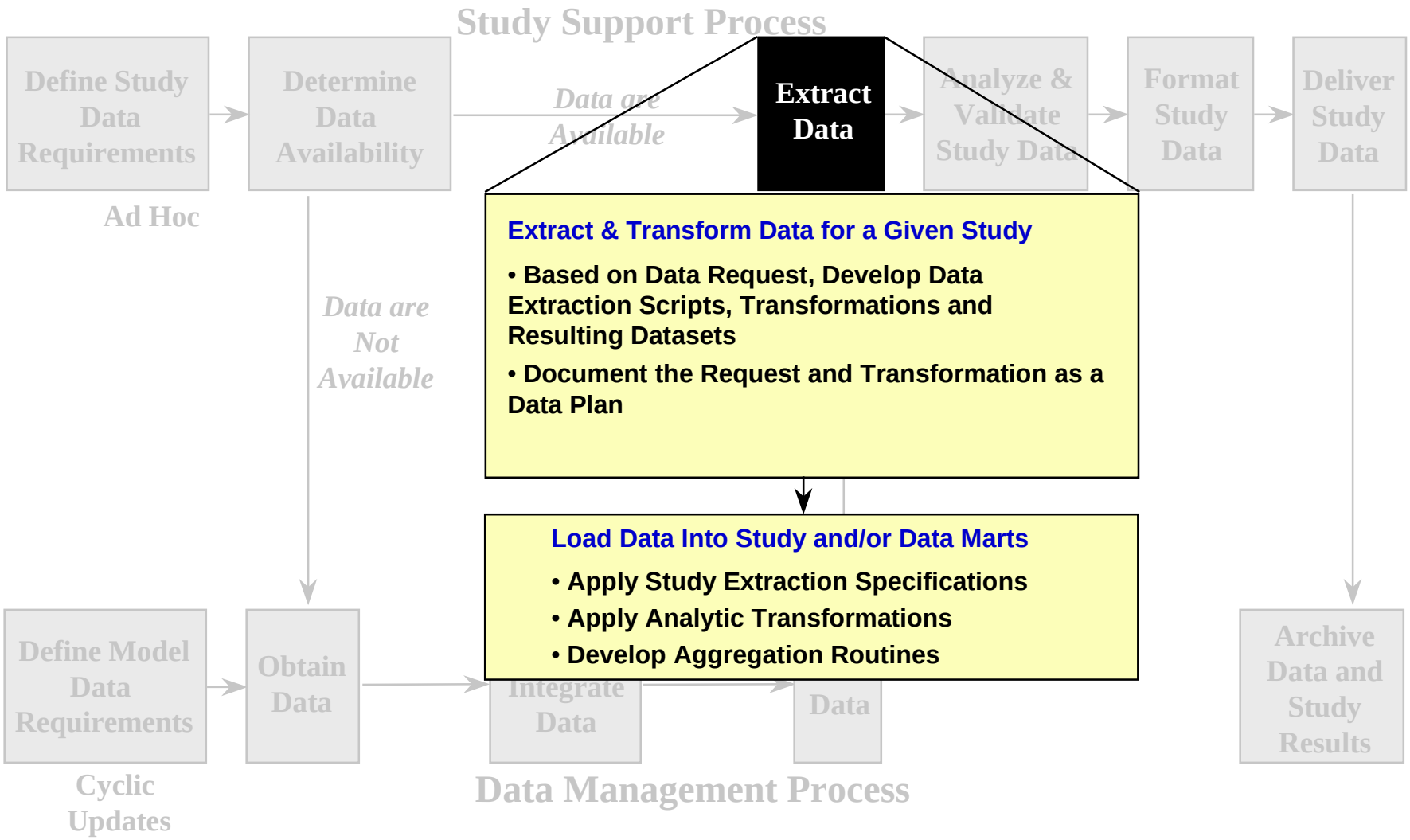
JDS Database Design Tools



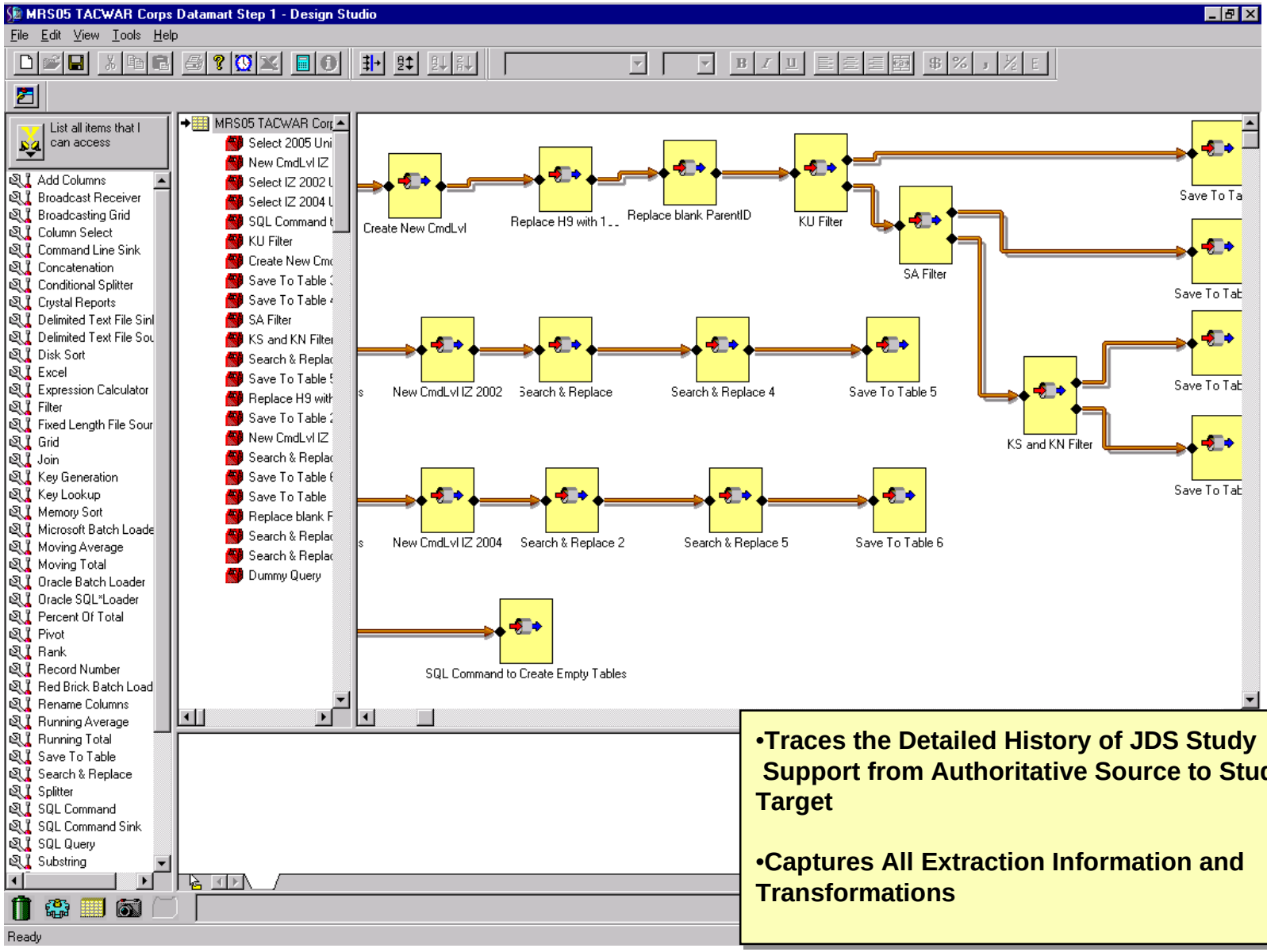
- **JDS is Designing an Atomic Level Operational Data Store with a Consistent Internal Nomenclature**
- **The Database Design is Organized Around Subject Areas; the Data Requirements of all Models are Considered Before Finalizing the Structure**
- **Each Subject Area Supports Traceability, Accountability, Security, Time Dimensions, Versioning, Aggregation, and Integration**

Joint Data Support Process

Extract the Data



Data Extraction & Transformation Tool

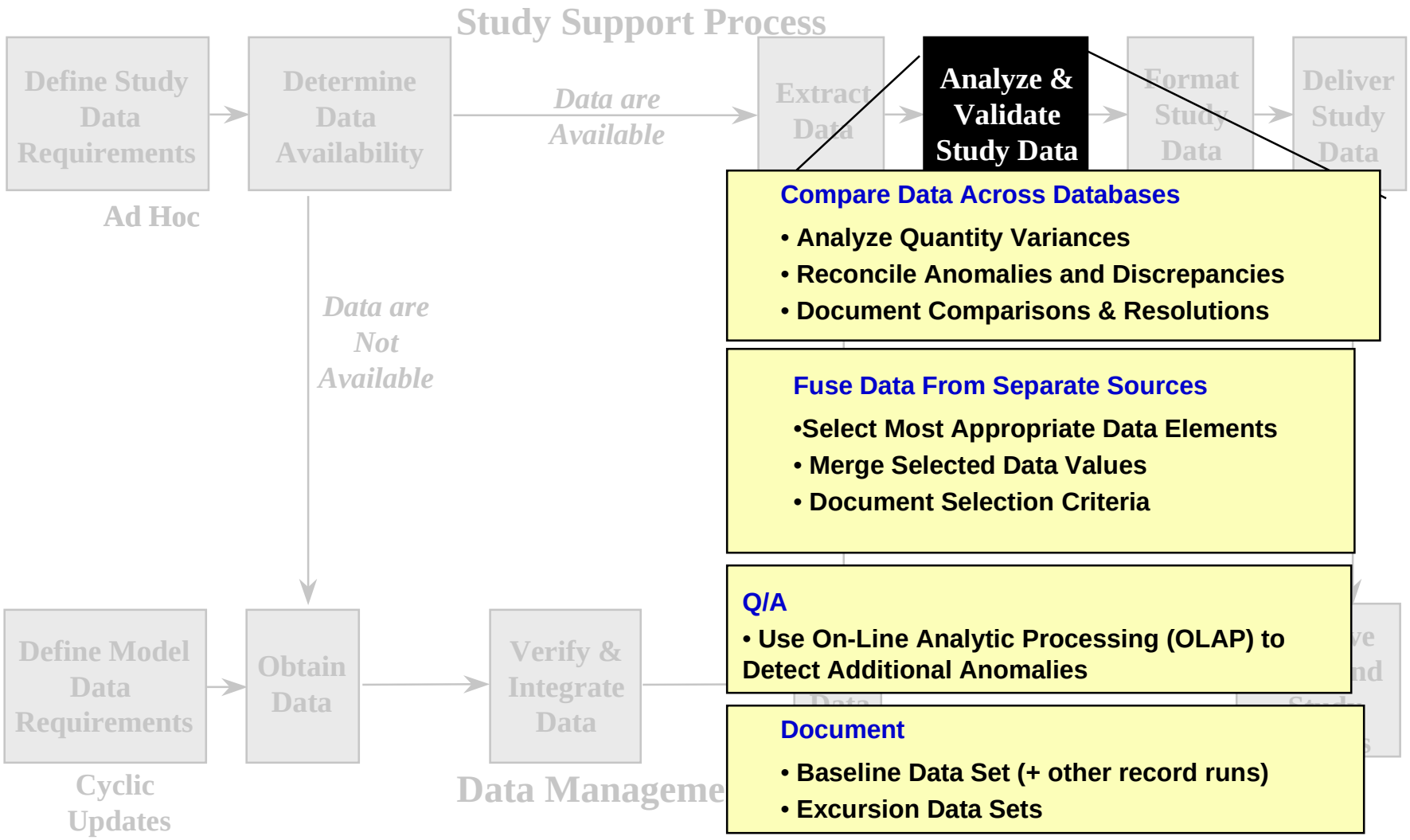


- **Traces the Detailed History of JDS Study Support from Authoritative Source to Study Target**

- **Captures All Extraction Information and Transformations**

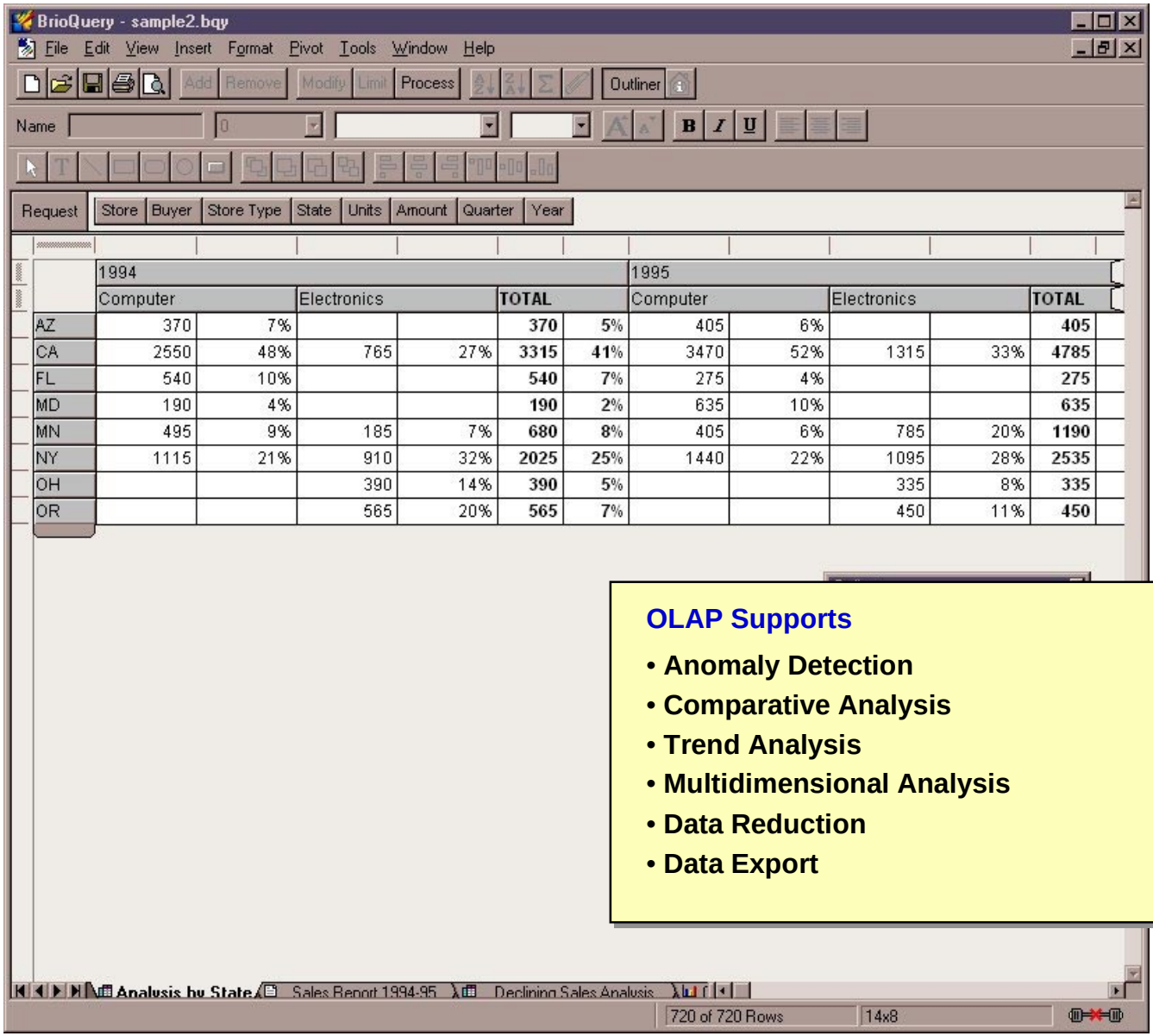
Joint Data Support Process

Analyze and Validate the Data



Joint Data Support Process

Analysis using On-Line Analytic Processing (OLAP)

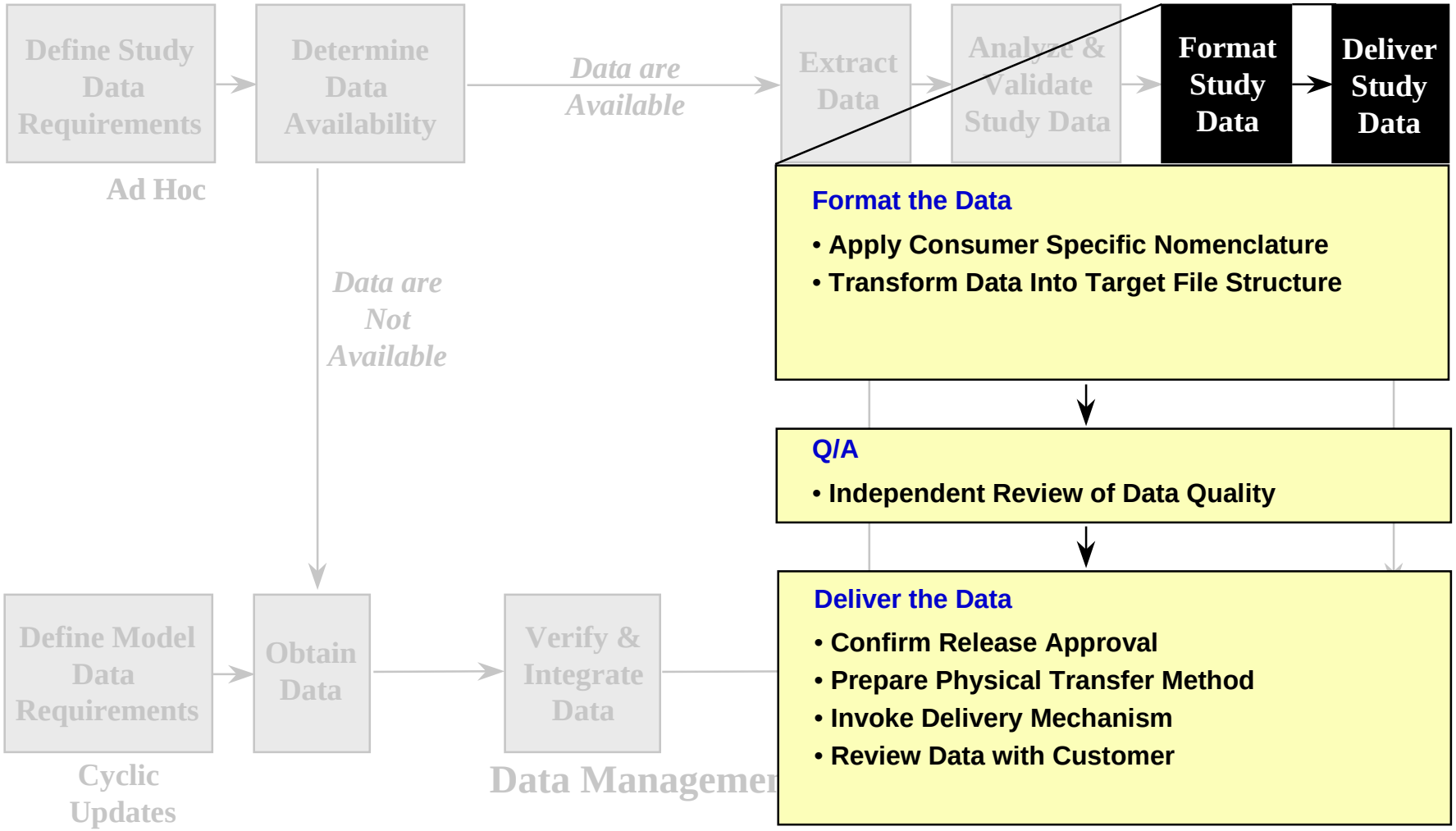


OLAP Supports

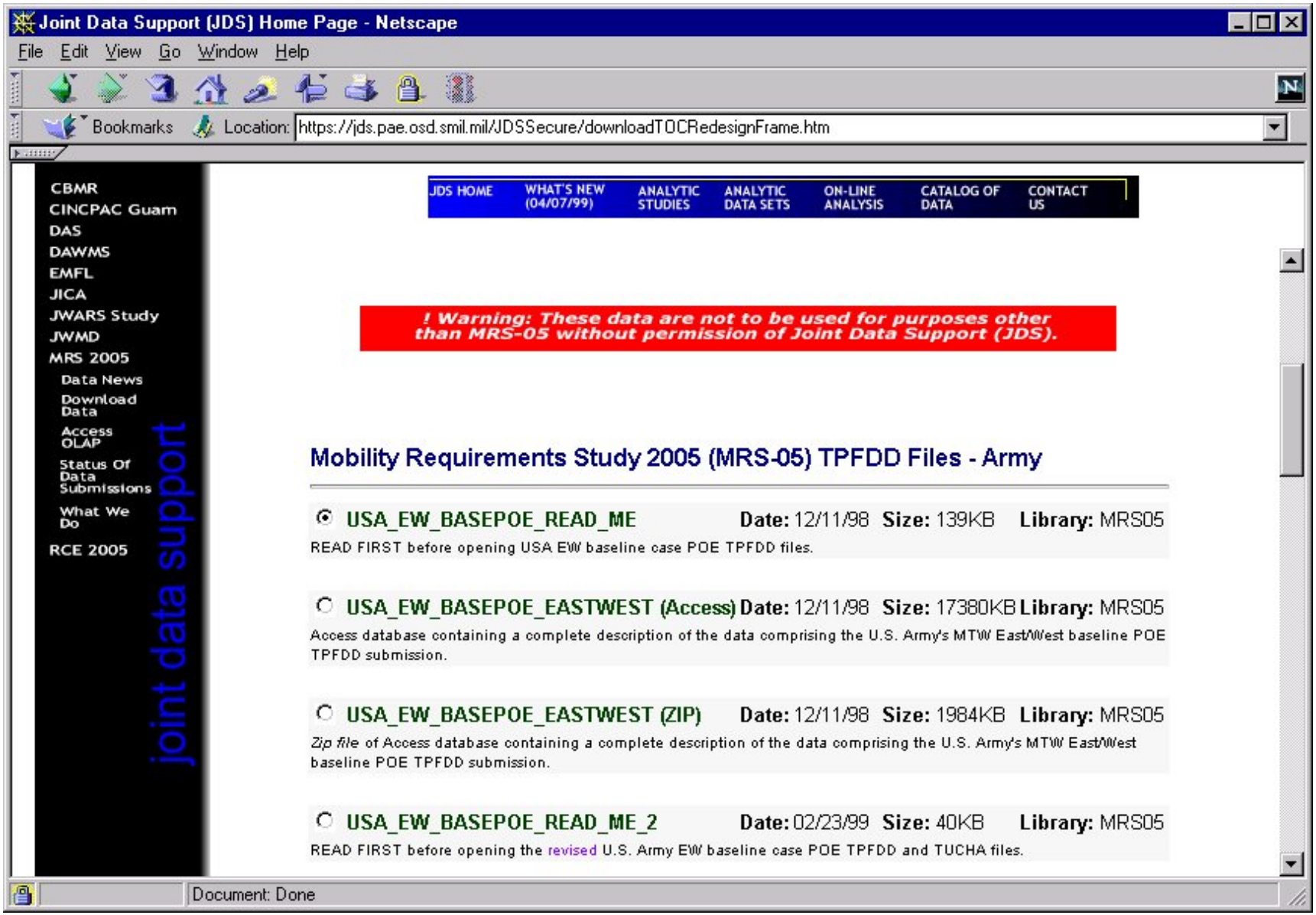
- **Anomaly Detection**
- **Comparative Analysis**
- **Trend Analysis**
- **Multidimensional Analysis**
- **Data Reduction**
- **Data Export**

Joint Data Support Process

Format and Deliver the Data

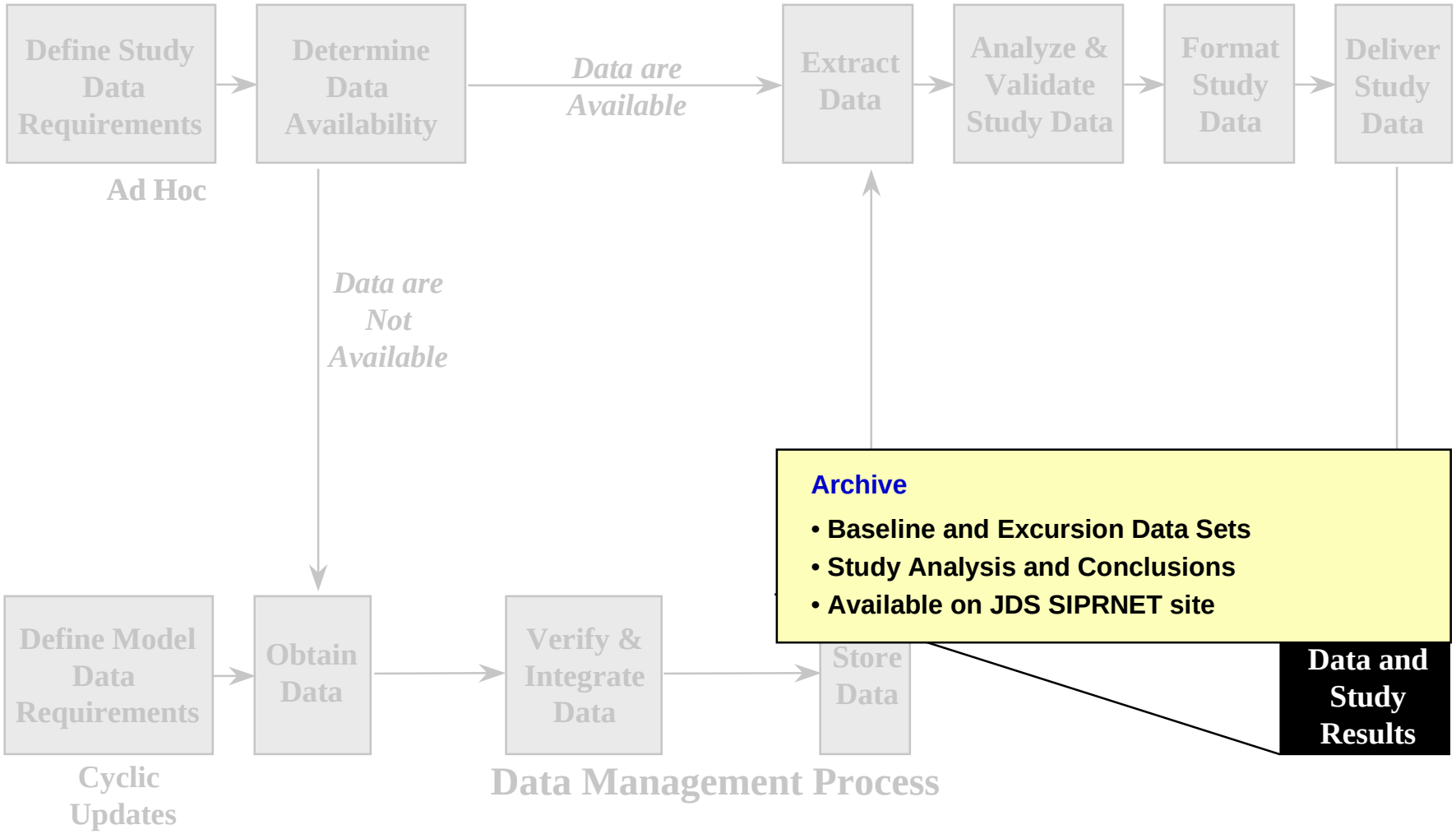


SIPRNET Web-Site for Data Access & Archive

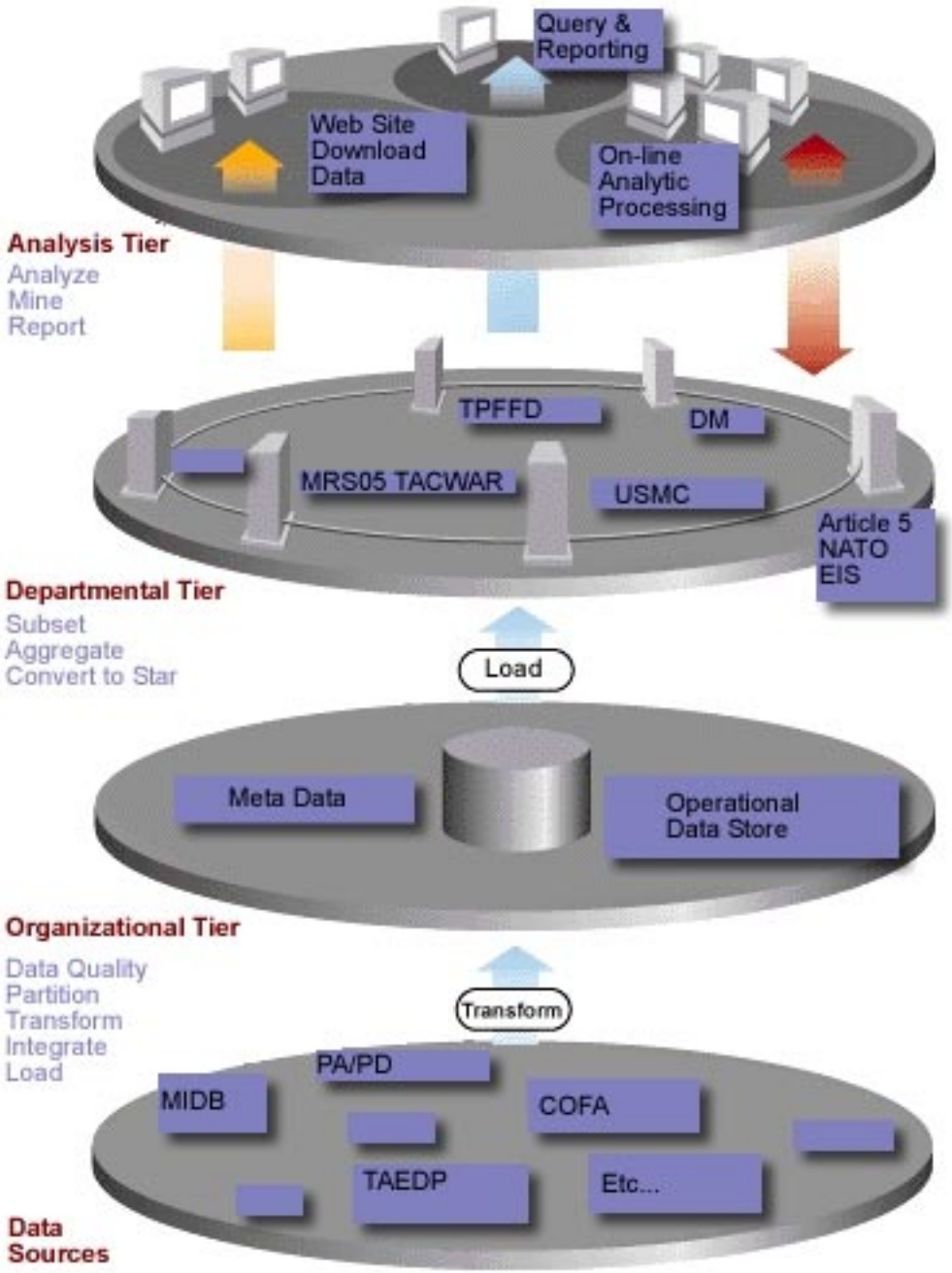


Joint Data Support Process

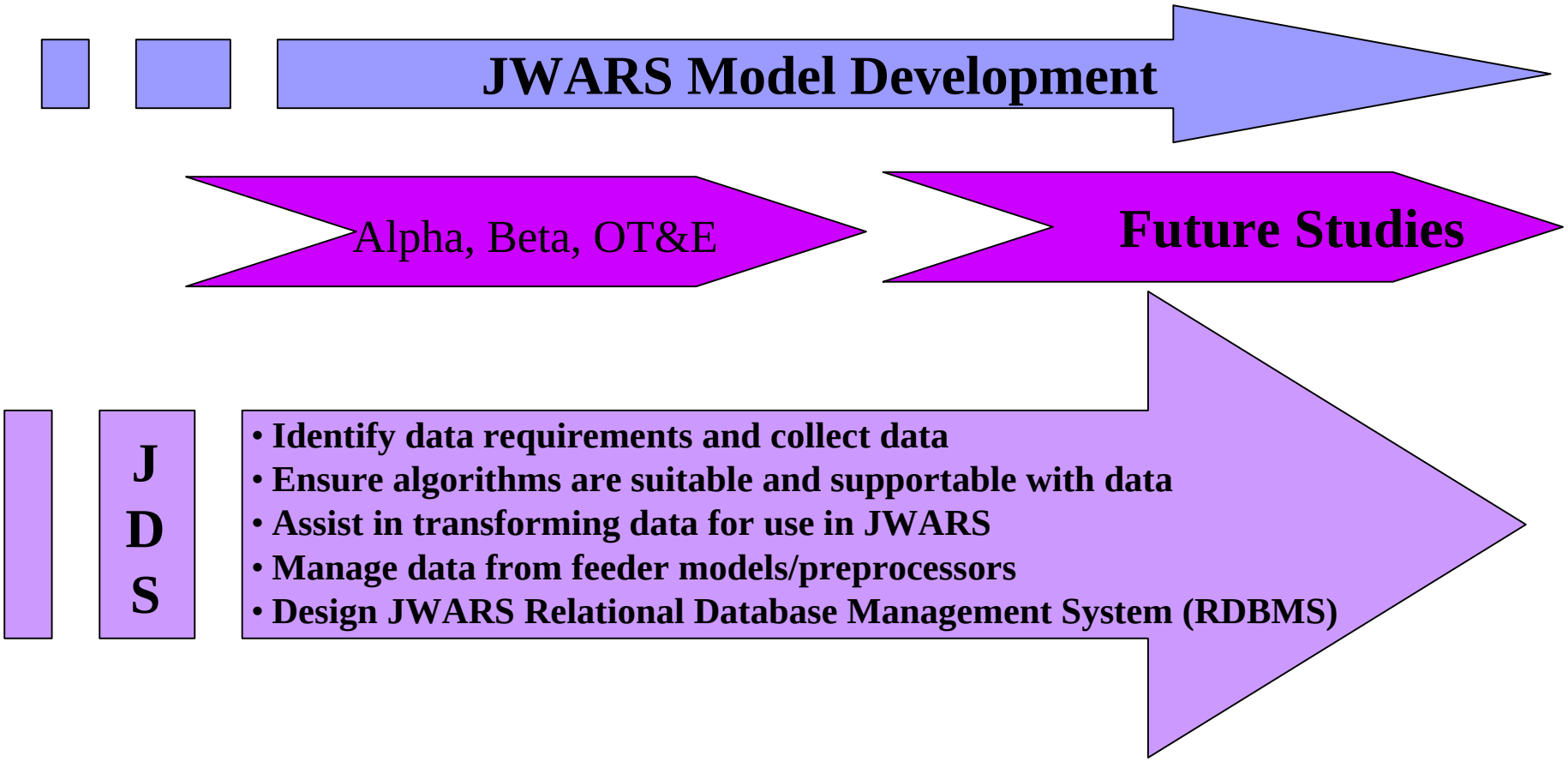
Archive the Data



Joint Data Support Data Architecture



JDS Role in Supporting JWARS



Joint Data Support

Emerging JWARS Data Requirements
(A Brave New World)

	Legacy Models	JWARS
Domains	**1 or 2:** **Land, Air (Thunder, TACWAR)** **Sea, Air (ITEM)** **Air-centric (Brawler)** **Land-centric (VIC)** **Mobility-only (MIDAS)**	**8:** **Space; Air; Land; Sea; Sub-Surface; Mobility; Logistics; Perception**
Domain Interfaces	**1 or 2:** **Land-Air (Thunder, TACWAR)** **Sea-Air (ITEM)**	**At least 6:** **Land-Air; Sea-Air;** **Land-Sea; Land-Subsurface;** **Sea-Subsurface (Mine Warfare);** **Air-Subsurface (USW)**
Departments	**Typically 1 represented fully**	**All Fully Represented and Balanced Across Departments**
Command and Control	**Maximum of 4** **Typically Scripted**	**Theater/Corp/Division Modeled** **Brigade Limited Options** **Dynamic Closed-Form C4ISR**

Joint Data Support

Operational and Performance Data

	Functional Areas					
☞ N-Sided ✧ US, Enemy, Allied, Coalition, Neutral, Unknown ☞ Across All Warfare Domains ✧ Land, Sea-Surface, Sea-Subsurface, Air and Space ☞ Across All Military Departments ✧ Joint, Army, Navy, Marine Corps, Air Force, Non-Conventional Forces	Attrition	Movement & Maneuver	Sustainment & Consumption	Communications	Intelligence, Surviellance & Reconnaissance	Command & Control
Doctrine & Tactics		Y	Y	R	R	R
Decision Rule Sets		Y	R	R	R	R
Activities, Postures, Formations & Behaviors	Y	Y	Y	Y	Y	R
Aggregated System Performance Characteristics	G	G	G	Y	Y	
System Performance Characteristics	G	G	G	G	G	

Green: We know how to model it and support it with data and/or we are using legacy model representations
Yellow: It has been explored before, difficult to do but not insurmountable
Red: Breaking new ground, represents cognitive processes

Joint Data Support

Data for JWARS Release 1.0

- **Minimum Essential Data for Testing:**
  - ☞ **Consistent with model algorithms and at an appropriate level of fidelity for test purposes**
  - ☞ **May need to be updated for use in a specific study**
  - ☞ **Data from separate sources may not be fully reconciled**
  - ☞ **Lead time on preprocessed data drives use of "off the shelf" data (not preprocessed specifically for JWARS)**
  - ☞ **JDS/JWARS/JST will transform inputs to create "JWARS ready" data**

Joint Data Support

Challenges

- Sensitivities with data (future threats, low observables, proprietary data)
- Expanded scope of functional areas to be explicitly modeled (WMD, logistics, C^2 , weather)
- Identifying data elements that matter
- Reconciling Service data to create “Joint” data (sortie rates, weapons allocations)
- JWARS specific: gleaning data requirements early in development